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IN REPLY REFER TO

OPNAVINST 9010.344
OP-03C

01 APR 1991


OPNAV INSTRUCTION 9010.344

From: Chief of Naval Operations

Subj: OCEANOGRAPHIC SURVEY SHIP T-AGS OCEAN (ICE) TOP LEVEL
REQUIREMENTS (TLR)

Encl: (1) Oceanographic Survey Ship T-AGS OCEAN (Ice) Top Level
Requirements

1. Purpose. To issue the approved Top Level Requirements for the ice capable Oceanographic Survey Ship T-AGS OCEAN (Ice).
2. Applicability. This Top Level Requirement is only applicable to the ice capable Oceanographic Survey Ship T-AGS OCEAN (Ice) in the FY-92 Shipbuilding and Conversion Program.
3. Discussion. This TLR is based on the T-AGS-60 Class specifications and reflects changes required for operating in the marginal ice zones. Changes to this TLR must be kept to a minimum. Therefore, any changes which would result in a costly and time consuming impact on the ship's construction schedule must be fully justified. Proposed changes to the characteristics of this ship shall be submitted to the Chairman of the Ship Characteristics and Improvement Board for approval by the Chief of Naval Operations.


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Assistant Chief of Naval Operations
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OCEANOGRAPHIC SURVEY SHIP, T-AGS OCEAN (ICE)
TOP LEVEL REQUIREMENTS
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1. OVERVIEW

1.1 Objectives and Scope

a. This document specifies the Top Level Requirements (TLR) for the Oceanographic Survey Ship T-AGS OCEAN (Ice). The ship will be operated by the Military Sealift Command (MSC) and the scientific and mission spaces will be manned by the Naval Oceanographic Office (NAVOCEANO). Included in this TLR are the ship's mission, operational requirements, major configuration constraints, plan for use, maintenance concepts, and supply support concepts.

b. The objective of the T-AGS OCEAN (Ice) Ship Acquisition Program is to acquire an oceanographic ship to meet worldwide oceanographic and data collection requirements, including operation in the Marginal Ice Zone (MIZ).

c. The format of this TLR has been developed following the requirements of OPNAVINST 9010.300A.

1.2 Constraints

a. Initial Operational Capability (IOC) for the T-AGS OCEAN (ICE), is FY96 or earlier.

b. If the provisions of this TLR cannot be met, the Commander, Naval Sea Systems Command will advise the Chief of Naval Operations (OP-096).

1.3 Design Guidance

The T-AGS OCEAN (Ice) shall be built to commercial standards and shall comply with all the applicable laws of the United States and the requirements of the regulatory bodies, American Bureau of Shipping (ABS), United States Coast Guard (USCG), SOLAS, 46 CFR Subchapter U (Oceanographic Ships), U.S. Public Health Service and Federal Communications Commission. The ship shall be classified by ABS to Maltese Cross A1 CIRCLE E, Maltese Cross AMS, Maltese Cross ACCU, and Ice Navigating Class A1.

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The ship shall be certified by the USCG.

The ship shall satisfy all the requirements for transit of the Suez Canal and Panama Canal, including tonnage certificates.

Compliance with the General Specifications for Ships of the U.S. Navy, or other military requirements, is required only as noted herein.

2. MISSION STATEMENT

2.1 Mission

The mission of the Oceanographic Survey Ship (T-AGS OCEAN (Ice)) is to provide general purpose oceanographic capabilities in coastal and deep ocean areas, including the MIZ. Typical missions will include:

- * Surveys (bathymetry, gravimetry, and magnetometry)
- * Physical, Chemical and Biological Oceanography
- * Multi-discipline Environmental Investigations
- * Ocean Engineering and Marine Acoustics
- * Marine Geology and Geophysics

2.2 Primary Tasks

To carry out the mission, the T-AGS OCEAN (Ice) shall be capable of performing the following tasks:

- a. Precise navigation, station keeping, and track-line maneuvering to support deep ocean and coastal surveys.
- b. Oceanographic sampling and data collection of surface, midwater, and sea floor parameters using state-of-the-art scientific instrumentation.

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c. Launch, recovery, and towing of scientific packages, both tethered and autonomous, including the handling, monitoring, and servicing of remotely operated vehicles.

d. Shipboard oceanographic data processing and sample analyses.

2.3 Secondary Tasks

a. The T-AGS OCEAN (Ice) has no wartime mission.

b. Day-only, hover-only capability by commercial helicopter shall be provided for emergency medical and humanitarian evacuation.

3. TOTAL SHIP REQUIREMENTS AND CHARACTERISTICS

3.1 Command, Control, and Communications

Facilities shall be adequate for scientific and survey operations and shall include the following:

a. Ship handling and maneuverability, including manual and automatic steering control, to permit open water station keeping, track keeping, and the launch and recovery of large scientific packages and vehicles.

b. The pilot house shall be located at or near amidships. Satisfactory visibility is required from pilot house forward and from the bridge wings forward and aft. Bridge wings shall be enclosed from beam to beam, as integral parts of the pilot house. The functions, communications, and layout of ship control must allow the close interaction of ship and scientific operations. The propulsion system and the thrusters shall be controllable from the pilot house.

c. Communications, navigation, and Interior Communication systems are listed in Appendix A.

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3.2 Acoustic Characteristics

a. The shipboard acoustic systems are identified in Appendices A and B. The mounting, configuration, and location of the sonar systems shall be selected to reduce hull-induced flow noise and bubble-sweepdown interference as much as possible within the current state-of-the-art for this type of acquisition. All installed sonars shall operate at ship speeds up to 12 knots in waves up to 8 feet significant wave height in open water.

b. The choice of shipboard hull and machinery systems, their locations, and their installation shall be made to reduce impact on the operation of shipboard acoustic systems within the current state-of-the-art for this type of acquisition.

c. Airborne noise levels shall meet the same criteria as used on T-AGS 60 Class.

d. Quiet ship/drift operation: The ship shall be capable of accommodating a self-contained minimum 100 KW electrical generator to maintain basic scientific and ship service loads for a period up to 6 hours. This capability meets the requirements for occasional quiet mission operations.

3.3 Survivability, Including Passive Protection

a. All radiators and receptors of electromagnetic energy and related electronics on the T-AGS OCEAN (Ice) shall be designed and installed to ensure electromagnetic compatibility (EMC) and to avoid hazards of electromagnetic radiation to personnel (HERP) and fuels (HERF). Automated control systems shall not respond spuriously to electromagnetic interference (EMI) from radiating sources or to transients in power lines.

b. Damage Control capability shall meet MSC standards.

c. No offensive or defensive weapons capabilities are required. Chemical, biological, and radiological defense (CBR-D) equipments, including radiac, are not required.

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d. The ship shall meet the applicable stability requirements with three (3) inches of topside icing.

3.4 Mobility

A sustained speed of 16 knots is required in calm water at 80 percent MCR. A speed of approximately 15 knots is required in open water at all headings up to a significant wave height of eight (8) feet. A speed of 10 knots is required in open water at best heading up to a significant wave height of 12 feet. The ship shall be capable of 12,000 NM at 12 knots plus 30 days at three knots. A 10 percent fuel reserve shall be provided based on total fuel required.

3.5 Operating Environment

The T-AGS OCEAN (Ice) shall perform its mission under weather conditions ranging from tropic to the MIZ and shall be capable of navigation in first year open pack ice of 4/10 to 6/10 concentration and thin to medium level ice.

The ship must meet the requirements associated with ABS A1 Ice classification criteria in terms of hull structural strength, appendage design, and propulsion system design. There is no mission-related icebreaking performance requirement.

3.5.1 Temperature and Humidity

Habitability areas and mission essential spaces shall be air conditioned and shall be designed for a maximum external air temperature of 95 degrees Fahrenheit dry bulb (82 degrees Fahrenheit wet bulb), with a maximum sea water temperature of 95 degrees Fahrenheit, and minimum external air temperature of -20 degrees Fahrenheit with a minimum seawater temperature of 28 degrees Fahrenheit. In addition, a 20 knot wind shall be assumed. Air conditioning for all laboratory spaces and interior scientific operations spaces shall be designed to provide a maximum temperature of 75 degrees Fahrenheit with maximum relative humidity of 55 percent. Heating for these spaces shall be designed to provide a minimum temperature of 70 degrees Fahrenheit. Low Density scientific storage compartments shall be designed to maintain 70-80 degrees Fahrenheit dry bulb with maximum relative humidity of 55 percent. High Density mission scientific storage compartment shall be designed to maintain

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40-45 degrees fahrenheit during heating season.

3.5.2 Wind and Sea Conditions

The ship shall have the capability of station keeping within a 300 foot radius watch circle at best heading with a wind speed of 27 knots and a 2 knot current through a significant wave height of 12 feet in open water. In the same environment, the ship shall also maintain trackline within plus or minus 300 feet at 2.5 knots with a 10,000 lb towing force, over any track bearing with ship heading +/- 45 degrees to the track bearing. The ship shall have the capability of launching and recovering equipment at best heading up to a significant wave height of 11 feet.

3.6 Ship Utilization

The T-AGS OCEAN (Ice) will have an irregular deployment cycle. The ship is expected to average 250 days per year at sea.

3.7 Maintenance, Overhaul and Supply Support Concepts

3.7.1 Logistics Support

a. The T-AGS OCEAN (Ice) shall be supported within the Navy supply system.

b. Support planning shall satisfy Navy policy on Integrated Logistics Support (ILS) as contained in SECNAVINST 5000.39A and OPNAVINST 5000.49A (NOTAL). Allowance lists for the T-AGS OCEAN (Ice) shall be developed to sustain ship operation for 90 days using the Modified Fleet Logistic Support Improvement Program (MOD FLSIP) model for the ship's allowance. Hull, Machinery and Electrical systems shall be fully supported within the Navy Supply System, including the use of a standard Navy Consolidated Ships Allowance List (COSAL). The Mission Electronics Equipment shall be supported by NAVOCEANO, including the use of a Survey Equipment Allowance Parts List (SEAPL) developed by NAVOCEANO. The SEAPL is based on a modified COSAL format.

3.7.2 Maintenance Support

a. The T-AGS OCEAN (Ice) shall be self-sufficient for regular preventive maintenance. Onboard maintenance and repair capability shall meet USCG and ABS requirements.

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b. The T-AGS OCEAN (Ice) shall be capable of limited emergency repair of hull structure and engineering casualties, including the following:

- (1) Limited repair of above-water hull structure.
- (2) Minor steering system and shafting repair.
- (3) Minor propulsion, auxiliaries, electrical, and deck machinery repairs.

c. The maintenance and overhaul concepts for the T-AGS OCEAN (ICE) shall be consistent with MSC practices.

3.7.3 Supply Support

a. The T-AGS OCEAN (Ice) shall carry consumables using MSC stowage factors adjusted for ice operation for 62 personnel as follows:

Dry Stores	90 days
Frozen	90 days
Chilled	45 days
Medical	120 days

b. Separate stowage spaces shall be provided for deck, engine, medical, and steward stores.

3.8 Manning and Habitability

3.8.1 Manning

Manning shall be constrained to the accommodations stated herein and shall comply with USCG regulations.

3.8.2 Habitability

The following staterooms shall be provided:

Single SR: 8	Officer (private T/S)
5	Chief Petty Officer (CPO) (semi-private T/S)
2	Scientist (private T/S)
15	Staterooms

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Double SR: 6 Crew (semi-private T/S)
 15 Scientist/Technician (semi-private T/S)
 21 Staterooms

Spare SR: 1 Single (semi-private T/S)
 2 Double (semi-private T/S)
 3 Staterooms

a. Messing and berthing spaces shall meet MSC habitability standards.

b. Separate office space shall be provided to conduct the business of the ship (engine, deck, and supply/steward's department). Separate office space shall be provided for survey mission business.

c. A hospital space, an exercise room, and self-service laundry facilities are required.

d. A common galley for cafeteria-style feeding shall be provided. Two separate messing facilities shall be provided: one for officers, scientists, and technicians and the other for CPOs and crew. Each messing facility shall include a lounge area for recreation and training purposes. The following are the minimum mess seating requirements:

Officers	100 percent of accommodations
CPO and Crew	60 percent of accommodations
Scientists/Technicians	60 percent of accommodations

3.9 Flexibility for Change, Including Space and Weight Reservations

a. Design and outfitting shall provide for rapid scientific payload changes and ship redeployments. This requires optimum access to work and storage areas, and laboratory facilities to permit changeout of electronics and other laboratory internal equipment.

b. Service life allowance of five percent of full load displacement and 0.5 foot of KG shall be provided.

4. Subsystem Requirements and Characteristics

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4.1 Propulsion System

The following specific capabilities and characteristics are required:

- a. The prime movers shall be diesel engines, using marine diesel fuel.
- b. An electric propulsion system is required, capable of continuous operation throughout ship speeds varying from 0 knots to full power speed.
- c. Economy of operation shall be considered during the design.
- d. A central machinery control space shall be provided for operation and monitoring of propulsion and auxiliary machinery systems. This space shall be located within or adjacent to the machinery space boundary.

4.2 Electric Plant (Scientific purposes)

- a. Provision shall be made for clean power to support a scientific load of approximately 100 kilowatts, including a 12 KW Uninterruptible Power Supply (UPS) capable of 15 minutes of independent operation.
- b. Included in the 100 KW total, shall be 37 KW of regulated power for scientific data processing systems.

4.3 Command, Surveillance, and Scientific Mission Requirements

- a. Mission support equipment is listed in Appendices B and C.
- b. The following scientific facilities shall be provided and, where practical, located adjacent to one another in the area of the ship which experiences the least motion in a seaway:

(1) Deck - Working Area: Approximately 3,500 sq. ft. of fantail working deck area shall be provided. Working deck design unit loading shall be 1,500 lb/sq. ft. The working deck shall be 6 feet to 10 feet above the design water line. All hatches on the working deck shall be of the flush-type. A disposable load of 72 tons shall be accommodated at the working deck level and 28 tons shall be accommodated in the SUS charge van locations.

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(2) Vans: Additional deck area (working deck or 01 deck) for four 8 ft x 8 ft x 20 ft standard vans shall be provided near the lab complex and working deck, with direct access to the ship's interior. The deck area for vans on the working deck shall have a 1,500 lbs/sq. ft. design unit loading. The ship's cranes shall be capable of onloading and offloading vans up to a weight of 20,000 lbs. Two of the van sites shall be configured for SUS charge storage and one van site shall be configured to support a quiet ship/drift generator.

(3) Laboratories: Approximately 4,000 sq. ft. of laboratory space shall be provided and shall be distributed among the following spaces: Main Lab, Electrical Shop, Dry Lab, Photo Lab, Wet Lab and Staging Bay, Drafting Room, Scientific Freezer, and Climate Control Chamber Lab. Provisions for handling and storage of chemical material shall be provided adjacent to laboratory areas. Chemical laboratory hoods shall be provided in the Wet Laboratory and Bio-chemical Laboratory.

Rapid rearrangement and flexibility shall be facilitated by equipping selected spaces with flush-deck boltdown fittings on two foot centers and through the use of unistruts on overheads and bulkheads. Laboratory cleanliness is a major objective. Materials which permit achievement of this objective shall be used in construction of these spaces. Furnishings, Heating, ventilation, air-conditioning equipment, doors, hatches, cable runs, and fittings shall be selected for maximum lab cleanliness. These spaces shall have a minimum of 9 air changes per hour. Laboratories shall be furnished with 110 volt single phase and 208 volt three phase AC power. Uncontaminated sea water and fresh water, and clean, oil-free compressed air supplies with appropriate drains shall be provided in appropriate lab spaces.

(4) Scientific Storage: Two to four storage compartments with a combined total of approximately 15,000 cu ft (135 tons) shall be provided and shall be accessible from both the weatherdeck and the ship's interior. High density storage spaces shall be located aft with access to working areas by hatches using the ship's cranes. Maximum total weight in high density spaces is 100 tons.

(5) Other Scientific Spaces: In addition to the laboratories, a library/conference room with a minimum area of 350 sq. ft. and a survey office are required. An additional space adjacent to the afterdeck working area is required for the seismic system capacitor banks.

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(6) Overside Handling. Handling gear to accommodate overside operations shall include the capability to launch and retrieve equipment on the starboard side from midship to stern. This equipment shall include a 50 foot core sampler and other oceanographic packages up to 5,000 lbs in weight and measuring 20 feet long, 5 feet high, and 5 feet wide. Two outriggers on the stern deck shall be provided to accommodate six geophysical towed sensors.

(7) Mission-Related Deck Equipment. Cranes, winches, stern A-frame, and other deck gear shall be provided to permit loading and unloading the ship without assistance and to support a variety of oceanographic operations at sea, such as coring, water sampling, equipment implantation, and array and trawl towing. This deck equipment shall be located throughout the working deck area. Electric power shall be provided to the deck machinery locations as flush-mounted receptacles. The towing winch system shall include a slack tensioning sub-system and shall be located below decks to protect the gear and the winch watchstander from the weather during extended tow operations. Provision shall be made for the remote control of permanently installed mission-related winches from weather protected enclosures with maximum practicable visibility of the cable to the last overside block or sheave. These enclosures shall be fitted with remote readouts for wire out and tension.

c. A dynamic positioning and precision track-line system shall be installed. This system shall include two Global Positioning System (GPS) receivers (primary and spare), a precision timekeeping system, and a doppler speed log. The dynamic positioning system shall be capable of accepting navigational input data from a mission sponsor navigational computer, Global Position System, and an acoustic transponder system. Dynamic positioning performance requirements are given in paragraph 3.5.2.

d. The ship shall be capable of continuous tow of large scientific packages with tensions up to 10,000 lbs. at 5 knots and 20,000 lb at 2.5 knots.

e. Flush deck boltdown fittings shall be provided in a uniform grid pattern on 2-foot centers over the entire area of the working deck, staging bay, and van tie-down area.

f. Three 12-inch sea chests shall be provided for special mission gear.

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g. Two 24-inch scientific transducer tubes shall be provided fore and aft near the centerline and extending from the weather deck through the hull.

4.4 Auxiliary Systems

a. The following specific capabilities and characteristics are required:

(1) Fresh water making capacity shall be provided and shall consist of at least two units. Each unit shall be capable of providing no less than 4,000 gallons of water per day. Stowage in at least two tanks for a total of not less than 8,000 gallons of potable water shall be provided.

(2) A clean ballast system shall be provided. Dirty ballast shall not be permitted in any loading condition. Liquid ballast operations shall avoid partially full tanks in any hydrophone area.

(3) All overboard discharges shall be configured to restrict discharge to the port side of the ship.

(4) An uncontaminated seawater system shall be provided with bow inlet and distribution to selected laboratories. Materials for this system shall not contribute to biological or chemical contamination.

b. Pollution discharge from the ship shall be controlled. A shipboard sewage system, including transfer system, marine sanitation devices, and holding tanks with 24 hour capacity shall be installed. Oily waste separation equipment shall be provided.

c. A workshop shall be provided for both ship and scientific use and shall be furnished with industrial plant equipment (IPE) including lathe, drill press, grinder, milling machine, and electric arc and gas welding machines. The workshop shall be located adjacent to or within the engine room boundaries and shall be provided with suitable access for handling both ship and scientific equipment and material.

d. The stack exhaust shall be arranged to minimize airborne pollution of the shipboard environment and airborne noise on main and working decks.

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e. Laboratories, working deck stations, and van installation sites shall be provided with appropriate services.

f. Exposed deck equipment shall be able to operate in weather conditions ranging from tropics to the MIZ.

4.5 Outfit and Furnishings

Outfit and furnishings shall meet USCG requirements and MSC and commercial standards.

4.6 Armanent. Not applicable.

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APPENDIX A

T-AGS OCEAN (Ice) COMMUNICATION, NAVIGATION AND IC SYSTEMS

(Note: Mission Sponsor Equipment not included)

1. Infrared Facilities

None

2. Transmitting/Transceiving Facilities

- a. (1) 2-30 MHz Synthesized A1, A3A, A3J, A3H, F1; 1 KW output PEP ARQ (SITOR) (SELCALL)
- b. (1) 2-30 MHz Synthesized A3J, A3E; 125 Watt PEP
- c. (1) 156-162 MHz F3 (25W output)
- d. (1) 1.5-1.6 GHz INMARSAT Earth Satellite Terminal with 56 kilobit per second (kbps) data option
- e. (1) 500 KHz and 8364 KHz; A2 Portable
- f. (2) 406 MHz; A9 Portable, float free
- g. (1) 2-24 MHz; A1 (500 Watt)

3. Receiving Facilities (See Note 1)

- a. (1) 2-30 MHz; All Emissions (Part of 2a)
- b. (1) 2-30 MHz; A3J, A3E (Part of 2b)
- c. (1) 2182 KHz SOLAS Distress Monitor Receiver
- d. (1) 496-504 KHz Auto Alarm; A1A, A1B, A2A, A2B, H2A, H2B, J2A, J2B;

4. Terminal Facilities

- a. (2) ASR Teleprinter (Part of 2a and 2d)

5. Radar Facilities (See Note 1)

- a. (1) 10 CM Surface Search Radar (Raster Scan)
- b. (1) 3 CM Navigational Radar (Raster Scan), ARPA (Collision Avoidance)

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6. Sonar Facilities

- a. (1) Ship's Echo Sounder with Record Capability and Visual Indication (Navigation)
- b. (1) 200-300 KHz Doppler Speed Log (Dual Axis) in Pilot House; (Input to Collision Avoidance and SATNAV)

7. Countermeasure Facilities

None

8. Navigational Facilities (See Note 1)

- a. (2) Gyrocompass (1 - MK 37, 1 - MK 29)
- b. (1) SATNAV (GPS Capability with Remote) 4 Channel
- c. (1) Loran C (with Remote and Plot)
- d. (1) Automatic Radio Direction Finder
- e. (1) Dynamic Positioning System
- f. (1) Dual Autopilot Steering Control
- g. (1) Magnetic Compass

9. Radiac Facilities

Not Applicable

10. Remote Station Facilities

a. Pilot House

- (1) Radar Display/Control of 10 CM Radar (16 inch)
- (1) Radar Display/Control of 3 CM Radar (16 inch)
- (1) Control of Collision Avoidance System
- (1) Control of 2182 KHz SOLAS Distress Monitor Receiver
- (1) Loran C Remote Display
- (1) Control of Dynamic Positioning System
- (1) Wind Speed and Direction Readout
- (1) INMARSAT R/T Remote
- (1) Remote Control of 2-30 MHz Synthesized A3J, A3E

- (1) Mission Status Display - (Mission shallow water echosounder, ship trackline position, and GPS data display)
- (1) Ship's Echo Sounder Display
- b. Chart Room
 - (1) Display/Control of Ship's Echo Sounder
 - (1) Display/Control of Doppler Speed Log
 - (1) Display/Control of Automatic Radio Direction Finder
 - (1) Weather Facsimile
 - (1) Control/Display of Loran C #1
 - (1) Reception of Time Tick (from Communications Room)
 - (1) Mission Status Display - (Mission shallow water echosounder, ship trackline position, and GPS data display)
 - (1) Wind Speed and Direction Equipment
 - (1) Alarm Panel - Mission Void Bilge Water High Level
- c. Communications Room
 - (1) Control of Radio Facilities
 - (1) INMARSAT Terminal
- d. Main Laboratory
 - (1) Remote Display from Ship's Echo Sounder
 - (1) Remote Display from Ship's Doppler Speed Log
 - (1) Remote Display from Ship's Loran C #1
 - (1) Remote Display for Rudder (Thruster) Angle(s)
 - (1) Remote Display from Ship's Display and GPS
 - (1) Gyro Compass Repeater
 - (1) Data Input To Dynamic Positioning System
 - (1) Control/Display for Loran C #2
 - (1) Wind Speed and Direction Readout
 - (1) Remote from INMARSAT with 56 kilobit per second (kbps) data option
 - (1) Remote for Shaft(s) RPM
 - (1) Remote Display for Winch Line Readouts
- e. Winch Control Station
 - (1) Display for Ship Speed, Rudder Angle, Shaft(s) RPM, Ship Heading, Wire Out, and Tension

11. Meteorological Facilities

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Not Applicable

12. IC Facilities

a. Electronic IC System serving all operating spaces, laboratories, public spaces, working deck stations, and four van stations.

b. Dedicated IC System serving Main Laboratory, Pilot House, Winch Control House, and Working Deck aft.

c. Sound-powered Damage Control (DC) Circuit serving DC Central, Machinery Control Station, and key emergency stations.

NOTE: (1)

FCC, INMARSAT, and USCG approved equipment shall be provided to satisfy these requirements, as applicable.

Appendix A
to Enclosure (1)

APPENDIX B

T-AGS OCEAN (Ice) MISSION ELECTRONICS SYSTEMS

1. ADPE Suite (Data Acquisition, Navigation, and Processing Systems)
2. Acoustic Doppler Current Profiling System (RDI VMO150 or Equal)
3. Expendable Sensor System (XBT, XSV)
4. GPS, Standard Navy Shipboard User Equipment
5. Multi-Beam Sounding System
6. Subbottom Profiling System
7. Wide Beam Deep Water and Shallow Water Sounding Systems (One Each)
8. Seismic System
9. Meteorological Sensor Suite
10. Water Sampler System
11. CTD Profiling System
12. Bottom Transponder Navigation System
13. Magnetic Field Intensity Measurement System
14. Sea Surface Temperature/Sound Velocity Measurement System
15. Other Navigation Equipment (Loran C with RHO/RHO Capability)
16. Acoustic Release System
17. Special Laboratory Appliances/Facilities
 - Photo Lab Equipment
 - Scientific X-Ray Equipment
 - Fume Hood With Hazardous Material Stowage Under
 - Sediment Velocimeter
18. Vertical Reference System

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APPENDIX C

T-AGS OCEAN (Ice) MISSION SUPPORT EQUIPMENT

1. One Large Deck Service Crane
2. Two Articulated Cranes (One on Center Line for Towing Use)
3. Large Stern A-Frame
4. Starboard Side Aft U-Frame
5. Starboard Side Mid-Ship Articulated J-Frame
6. Two Hydro Winches
7. One Trawl/Coring/Traction Winch System
8. One General Purpose Winch
9. Scientific Support Vans
10. 19' Rigid Inflatable Boat (RIB)
11. Off-line Secure Communications
12. Magnetometer Winch
13. Regulated Power Supply/UPS System

Appendix C
to Enclosure (1)